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(54) Homopolar concentric field direct current machine

(57) A direct current machine rotor consists of a conductor (i) coiled around a segmented core (ii) of relatively low coercivity material, resulting in two consecutive rings of wound conductor situated between two POT type stator magnets (iii) of identical field orientations and possessing central bores for drive shaft (iv) access. These magnets induce an opposite pole in the core segments.

In the generator mode, the terminal voltage and current at the slip rings remains constant in magnitude and direction for an input, rotation constant in speed and direction.

FIG 1

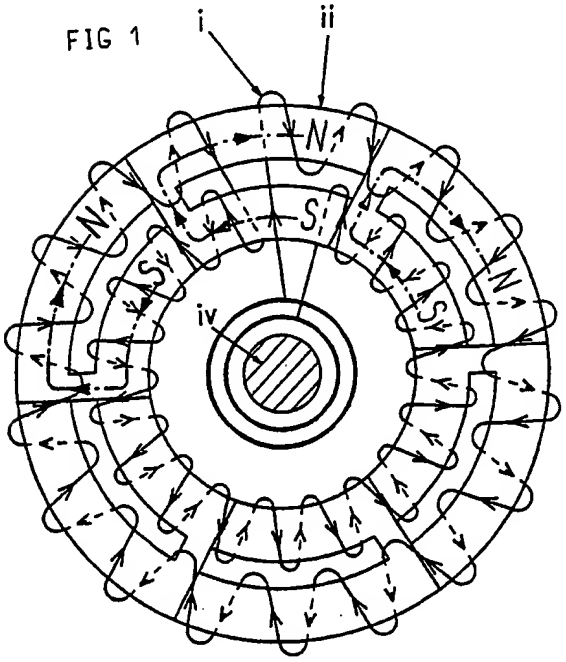
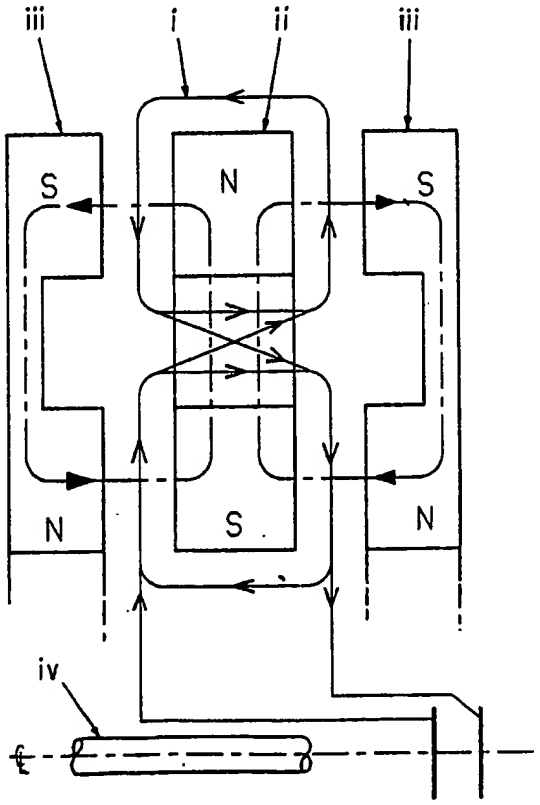


FIG 2



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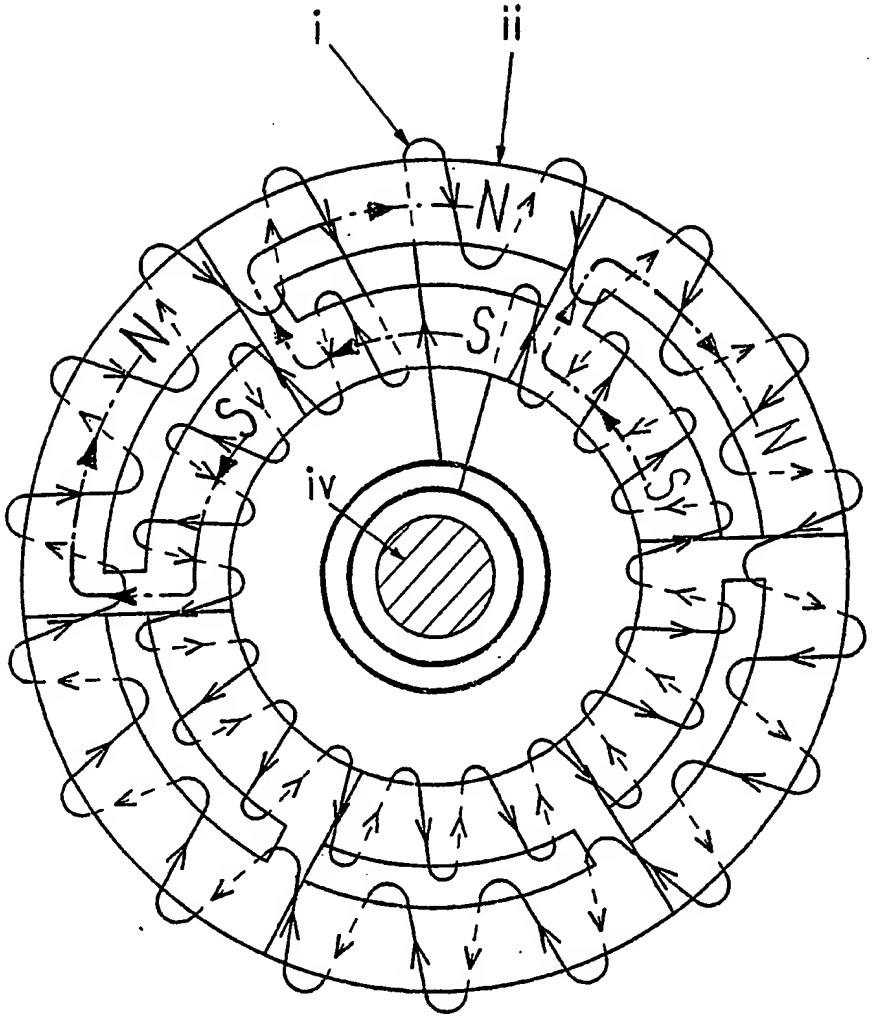

FIG 1

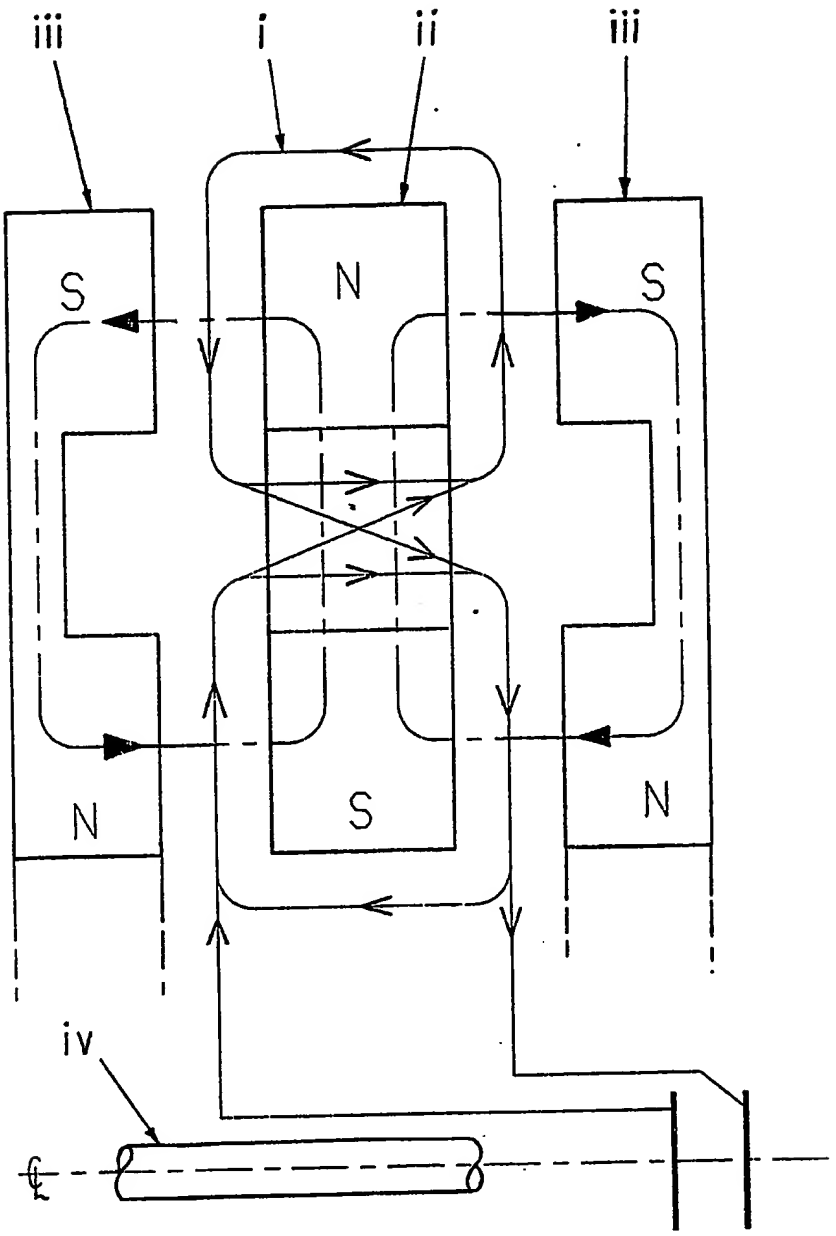

FIG 2

CONCENTRIC FIELD DIRECT CURRENT MACHINE

The present invention relates to dynamolectric machines, and more particularly to a machine with concentric axial fields constant in direction and magnitude through 360 degrees of arc about the axis of the rotor member.

Homopolar machines in which rotor conductors pass continuously through a unidirectional or unipolar magnetic field are well known. These machines are capable of producing relatively high outputs with fairly good efficiency, but the known types of homopolar type machines generally require strong magnetic fields and are inherently low-voltage, high current machines. The high outputs of these machines result in difficult current collection problems. For this reason, homopolar machines have not been used extensively, and have been considered suitable only for special applications. To overcome some of these problems, some machines have incorporated segmented magnets, dividing the magnetic field up into segments with corresponding rotor segments which may be connected in series to obtain the desired output voltage, but these can result in areas of zero magnetic field in which no usefull work is being carried out by the conductor; some of these machines also fail to make use of the conductor available and only use a small portion of the conductor to cut the magnetic field, or alternatively the winding is too costly or complicated to put into mass production.

The present invention provides an improved machine in which the problems discussed above are iliminated or minimised by using simply wound coils of conductor operating in concentric magnetic fields.

A specific embodiment of the invention operating as a generator will now be described by way of example with reference to the accompanying drawings FIGS 1 & 2, in which the prefered path of the conductor around the core is illustrated, and a section through the arrangement showing the flowpaths and field orientation.

With reference to the illustration Fig 2, the arrangement consists of two POT type magnets (iii) which possess identical field orientations and a central bore that allows installation of the drive shaft (iv). These magnets are aligned on the axis of the drive shaft with thier "like poles" facing each other, i.e. North pole opposing North pole and South pole opposing South pole.

With reference to the illustration Fig 1, a core of relatively low coercivity material (ii), i.e. a material that is capable of being magnetised but allows the magnetic field to slip around the material when the speeds of the two elements are different, is provided in segments, the numbers of which may vary to suit requirements. This segmented core (ii) allows the wound coils of the conductor (i) to be installed around, but insulated from the core segments (ii). And when the individual segments of the core with coils installed are assembled the result is two concentric rings of coiled conductor producing a circuit as illustrated in Fig 1.

With reference to the illustraion Fig 2, the two concentric rings of coiled conductor (i), installed around the core segments (ii), occupy the gap between the opposing faces of the magnetic poles of the POT magnets resulting in a magnetic circuit indicated by chain dot lines with solid arrowheads. The magnetic fields from the POT magnets (iii) induce an opposing pole in the relatively low coercivity material of the segmented cores (ii) resulting in axially aligned magnetic fields flowing in opposite directions.
The path of the e.m.f. in the circuit follows the path indicated by the solid continuous lines with the open arrowheads. Initially the e.m.f. travels around the coils (i) positioned between the North - South - North poles, then crossing diagonally to travel around the coils positioned between the South - North - South poles, and then can leave the circuit by again crossing diagonally to pass through the North - South - North pole's magnetic fields. The direction of the e.m.f. is reversed if the magnetic fields are orientated opposite to those indicated.

With reference to the illustrations Fig 1 and Fig 2, the circuit's flowpath results in the conductor continually cutting the magnetic flux in the same relative direction, resulting in an e.m.f. in the

conductive coils (i) that flows only in one direction.
As the coils (i) are always cutting the magnetic flux continually at any one point in time during operation, throughout the full 360 degrees of arc of rotation of the drive shaft, and as the motion of the coils (i) through the magnetic fields remains constant in speed and direction, the result is a terminal voltage and current that is constant in direction and magnitude.

The principle of obtaining a direct current electrical power from a mechanical imput applied to a drive shaft is reversed when this unit is required to function as a direct current motor.

CLAIMS

1. A direct current generator/motor machine comprising of stator members consisting of two POT type magnets with central bores and a rotor member consisting of a conductor wound around a segmented core of low coercivity material, assembled to form two concentric rings of wound conductor, and that a portion of each sement of core forms the connecting bridge between the two concentric rings to complete the magnetic circuit as illustrated by Fig 2. The rotor member assembly is supported for rotation co-axially of the stator members. The said rotor member assembly occupies the airgap between the two identical field orientated POT type magnetic stators to produce axially directed fields constant in polarity and direction throughout the 360 degrees of rotation around the drive shaft. A current collecting means for making electrical contact with the said conductor to form a completed electrical cicuit as illustrated in Figs 1 & 2.

2. A d.c. generator/motor as claimed in claim 1 wherein the rotor conductors comprise of wound coils of conductive material assembled onto segmented cores, but insulated from the segmented cores.

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